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Polysemies of the word libra: a pedagogical proposal through ethnomodelling

Polisemias de la libra: una propuesta pedagógica por medio de la etnomodelación

Polysémie de la Libra: une proposition pédagogique par l'ethnomodélisation

Polissemias da libra: uma proposta pedagógica por meio da etnomodelagem

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Abstract

The main objective of this research was to understand people's conceptions of the pound (lb) as a unit of measurement by demonstrating its polysemy, that is, its meaning, origin, ways of measuring it, and its uses. By considering different sociocultural contexts, we can propose pedagogical initiatives that connect these conceptions to mathematics education through ethnomodelling. This research is theoretically supported by the *program ethnomathematics* and ethnomodelling. The methodology is qualitative, ethnographic in character, and is based on an adaptation of grounded theory. Data collection involved semi-structured interviews with Colombian participants, field diaries, audiovisual records, and activities conducted with 8th-grade elementary school students at a state school in Ouro Preto. Among the results, the variety of polysemy of the pound and

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the influence of daily work on its conceptions stand out. These results also show that local mathematical knowledge related to concepts of the pound can be included in mathematics lesson plans, enabling the development of a dialogic (glocal) relation between local mathematical *knowings* and *doings* (emic approach) and global mathematical knowledge (etic approach).

Keywords: Ethnomodelling, Pound, Units of measurement, Conceptions, Culture.

Resumen

El objetivo principal de esta investigación fue comprender las concepciones de la libra (lb) como unidad de medida, demostrando su polisemia, es decir, su significado, origen, formas de medir y usos. Considerando los diferentes contextos socioculturales, podemos proponer iniciativas pedagógicas que conecten estas concepciones con la educación matemática mediante la etnomodelación. La investigación se sustenta teóricamente en el programa etnomatemática y la etnomodelación. La metodología empleada es cualitativa, con características etnográficas y un enfoque basado en la adaptación de la teoría fundamentada en los datos. La recolección de datos incluyó entrevistas semiestructuradas con participantes colombianos, diarios de campo, grabaciones audiovisuales y actividades con estudiantes de octavo grado de primaria en una escuela pública de Ouro Preto. Entre los resultados obtenidos, se destacan la variedad polisémica de la libra y la influência del trabajo cotidiano en sus concepciones. Los resultados muestran que existe un conocimiento matemático local relacionado con los conceptos de libra, que puede incluirse en los planes de estudio de matemáticas, lo que permite el desarrollo de una relación dialógica (glocal) entre los *saberes* y *haceres* matemáticos locales (enfoque émico) y el conocimiento matemático global (enfoque ético).

Palabras-clave: Etnomodelación, Libra, Unidades de medida, Concepciones, Cultura.

Résumé

L'objectif principal de cette recherche était de comprendre les conceptions de la Balance comme unité de mesure, en démontrant sa polysémie – c'est-à-dire sa signification, son origine, ses modes de mesure et ses utilisations. Compte tenu des différents contextes socioculturels, nous pouvons ensuite proposer des initiatives pédagogiques reliant ces conceptions à l'enseignement des mathématiques par l'ethnomodélisation. La recherche s'appuie théoriquement sur le programme d'ethnomathématique et l'ethnomodélisation. La méthodologie utilisée est qualitative, avec des caractéristiques ethnographiques, et repose sur une approche basée sur l'adaptation de la théorie ancrée. La collecte de données a consisté en des entretiens semi-directifs avec des participants colombiens, des journaux de terrain, des enregistrements audiovisuels et des activités menées avec des élèves de 4e année du primaire d'une école publique d'Ouro Preto. Parmi les résultats obtenus, la variété de la polysémie de la Balance et l'influence du travail quotidien sur ses conceptions se distinguent. Les résultats montrent qu'il existe des connaissances mathématiques locales liées aux concepts de la Balance, qui peuvent être intégrées aux plans de cours de mathématiques, permettant ainsi le développement d'une relation dialogique (glocale) entre les connaissances et pratiques mathématiques locales (approche émique) et les connaissances mathématiques globales (approche étique).

Mots-clés : Ethnomodélisation, Balance, Unités de mesure, Conceptions, Culture.

Resumo

O principal objetivo desta pesquisa foi compreender as concepções das pessoas sobre a libra (lb) como uma unidade de medida, demonstrando a sua polissemia, ou seja, o seu significado, a sua origem, as formas de medir essa unidade e as suas utilizações, tendo em vista os diferentes contextos socioculturais para, assim, propor ações pedagógicas que associem essas concepções com a educação matemática, por meio da

etnomodelagem. A pesquisa está teoricamente amparada pelo programa etnomatemática e pela etnomodelagem. A metodologia utilizada é qualitativa, com características etnográficas e uma abordagem baseada na adaptação da teoria fundamentada nos dados. Para a coleta de dados, foram utilizados entrevistas semiestruturadas com participantes colombianos, diário de campo, gravação audiovisual e atividades realizadas com alunos de 8º ano do ensino fundamental em uma escola estadual em Ouro Preto. Dentre os resultados, destacam-se a variedade de polissemias da libra e a influência do trabalho cotidiano sobre suas concepções. Os resultados obtidos mostram que existem conhecimentos matemáticos locais relacionados às concepções sobre a libra que podem ser incluídos em planos de aula de matemática, possibilitando o desenvolvimento de uma relação dialógica (glocal) entre os *saberes* e *fazeres* matemáticos locais (abordagem êmica) e os conhecimentos matemáticos globais (abordagem ética).

Palavras-chave: Etnomodelagem, Libra, Unidades de medida, Concepções, Cultura.

Polysemies of the word libra: A pedagogical proposal through ethnomodelling

Introduction

This research analyzed people's varied conceptions of the *libra* as a unit of measurement and its use in the routine of members of various cultural groups. The mathematical knowledge present in both libra and units of measurement in general was also studied, as well as how this knowledge can be connected to mathematics education through contextualized lesson plans, using the dialogical relationship of ethnomodelling.

This research considered the results of an investigative exchange process conducted by the first author in the 2025/1 semester between the Universidad del Atlántico (UA) and the Federal University of Ouro Preto (UFOP), public universities in Colombia and Brazil, respectively.

Thus, we investigated people's conceptions of the libra in both Brazil and Colombia. The results of the fieldwork conducted in Colombia made it possible to develop a contextualized lesson plan, which was applied in a state school in the city of Ouro Preto, Minas Gerais, Brazil, in order to disseminate the libra as a unit of measurement, as well as to know other ways of thinking about the term, whose objective was to promote the development of dialogical relationships between the *knowings* and *doings* of members of different cultures.

In addition, this research examined how the sociocultural context can positively influence mathematics education by enabling the development of contextualized curricula that give meaning to various globalizing mathematical content (Rosa & Orey, 2017a). Thus, we proposed the dialogical relationship between conceptions of the word libra

(emic knowledge) and the various formal mathematical contents studied at school (etic knowledge).

Many problems arise in the teaching and learning of mathematical content that addresses units of measurement. Such problems can open the door to the development and implementation of decontextualized mathematical curriculum activities that use standardized units of measurement and, on many occasions, disregard students' sociocultural contexts. This kind of traditional approach can create a gap in the meaning and mathematical significance for students, who are unable to relate the mathematical content they learn at school to their sociocultural context and environment, leading them to believe these elements are independent and isolated.

Therefore, several researchers in ethnomathematics and mathematics education (Blanco, 2008; Rosa & Orey, 2017; D'Ambrosio, 2018; Aroca, 2022; Rodríguez-Nieto et al., 2022; Madruga et al., 2024) have conducted scientific productions that highlight the importance of contextualizing mathematics curriculum activities according to students' sociocultural contexts.

Therefore, given that this study is mediated by ethnomodelling, we formulated the following research question: How can we connect the mathematical knowledge embedded in conceptions of *libra* to educational mathematics by creating ethnomodels?

Mathematics education must be linked to students' realities, considering their various ways of thinking mathematically, thereby developing their confidence and improving discipline both in class and outside the formalized school context (Rosa, 2010).

Currently, several units of measurement are used around the world, serving different cultures. People have developed their own ways of

measuring, many of which are non-standard and are disregarded in the mathematics curriculum implemented in schools in a globalizing society.

It is important to emphasize that this assertion is recognized by mathematical educators, as this cultural diversity extends beyond the measurement systems used by different communities to educational systems around the world (Aroca, Cantillo, & Pupo, 2022).

In this context, the importance of this research lies in the search for the interaction of *knowing/doing* developed by the members of different cultural groups, relating it to the mathematics of the school, thus helping the proposition of a contextualized curriculum that aims to provide significance and meaning to the teaching and learning process in mathematics.

Thus, the main objective of this study is to develop pedagogical actions that link mathematics education to conceptions of the libra through ethnomodelling.

Theoretical framework

The *programa etnomatemática* provides several references for this study, as well as the maturity and humbleness necessary to identify and value the knowledge, actions, and thoughts of members of different cultural groups that have developed over time, such as generating ideas, developing measures, calculations, interpretations, and gestures, which can be seen as objects of study.

In this case, for the different notions that members of different cultures have about the *libra* to be assumed regarding dialogue, some research found in the literature review, with a connection to the *programa etnomatemática*, provides support due to its focus on comparison, measurement, contextualization, and objectives.

For example, research conducted by Rodríguez-Nieto, Mosquera, and Aroca (2019), Aroca et al. (2022), Manchego, Utria, and Aroca (2024), Rey and Aroca (2011), Trujillo-Varilla et al. (2018), Rodríguez-Nieto et al. (2019), Aroca (2022), Muhtadi et al. (2017), Rosa and Orey (2012; 2017), De Oliveira and Mendes (2017), Cortes (2017), Morales and Rodríguez (2022), Quesada (2023), Rosa, Madruga, and Pinheiro (2024), and Rodrigues (2024) highlight the need to promote a dialogue between school mathematical knowledge and the students' sociocultural context.

Thus, this research arose from the authors' interest in knowing and studying people's conceptions of the term libra in both Colombia and Brazil, in order to understand its polysemic character and seek a dialogical relationship with the pedagogical processes present in mathematics education, as well as to problematize them through the application of a mathematics lesson plan.

***Programa etnomatemática*: moving towards ethnomodelling**

This study is based on the *programa etnomatemática*, through theoretical and methodological support that enables a holistic understanding of the conceptual diversity of the libra. Rosa and Orey (2005) propose *programa etnomatemática* as a field of research that can be described as the study of the history of mathematical ideas, procedures, techniques, and practices found in diverse and specific sociocultural contexts.

In turn, ethnomodelling can be defined as the intersection between ethnomathematics and the sociocultural perspective of mathematical modeling. From a general perspective, ethnomathematics concerns the study, valuation, respect, and dissemination of the various mathematical practices developed by members of different cultural groups. It is noteworthy that the sociocultural perspective of mathematical modeling

seeks to connect formalized school mathematics with everyday life to propose solutions to local phenomena and problem situations (Rosa & Orey, 2012).

Therefore, ethnomodelling studies the local mathematical practices found in different cultural contexts, aiming to problematize them by developing ethnomodels that strengthen the mathematics teaching and learning process, considering the plurality of sociocultural contexts in educational environments (Rosa & Orey, 2018).

Thus, ethnomodelling considers ethnomodels, defined as cultural fundamental artifacts for understanding mathematical systems of members of different cultural groups (Rosa & Orey, 2017b). The main objective of developing ethnomodels is related to the "translation of the procedures involved in the mathematical practices present in the systems taken from reality, which are symbolic systems organized by the internal logic of the members of these cultural groups" (Rosa & Orey, 2012, p. 870).

Due to their plurality, ethnomodels can be characterized as emic, etic, and dialogical (Rosa & Orey, 2017a). However, cultural, academic, and intercultural ethnomodels are also often used (Madruga, 2023). Gerdes (2013) says that ethnomathematics is a research program that respects and values the mathematical ideas, procedures, techniques, and practices present in the daily experiences of peoples, communities, social groups, and cultures.

These experiences are related to the study of this research on the libra, generating mathematical knowledge through the analysis of non-standard measures and tools for its use, aiming to assist in understanding the mathematical thinking of members of different cultural groups. The programa etnomatemática, with its six dimensions, can be understood under political, educational, epistemological, historical, cognitive, and

conceptual aspects, among others. In this research, the educational dimension is the primary focus in its development.

According to D'Ambrosio (1990) and Aroca (2022), the educational dimension is understood through the *programa etnomatemática* as a form of mathematics education and as a multidisciplinary and multicultural research program with pedagogical implications.

Historical context of the *libra*

The *libra-pound* (lb) is a unit of mass widely used in Colombia in various contexts. Currently, in that country, the standard value of the libra-pound is 500 grams. However, this is not always the case, as this measure has many different values around the world and is related to other units of measurement. In Brazil, the libra-pound uses the Imperial System of Measurements, which defines 1 lb as approximately 454 grams. The first measurement systems emerged from human beings' need to count, and have since been progressively developed. In this context, Kula (1999) stated:

> Simplifying the issue and approaching it from an evolutionary point of view, we can affirm that the first evolutionary period of the metrological notions of man is the anthropometric one, in which the basic units of measurement are parts of the human body. The following period looks for units of measurement in the conditions, objects, and results of human labor. The development of the metrological system and each of its component parts was obviously dictated by living and working conditions (Kula, 1999, p. 5).

Thus, when discussing the origins of measurements, we must go back to ancient times, when Indigenous peoples used body parts to estimate measurements and establish standards. The Colombian Ministry of National Education (MEN, 2006) points out that "historically, metric thinking was perfected with the refinement of units of measurement of length, originally taken from body parts and, therefore, very diverse

between regions and cultures, which were then standardized for trade and industry" (p. 63).

The above suggests a view of measurement systems from a sociocultural perspective, whose origins lie in local practices developed by members of different cultural groups, alluding to the fact that *knowing/doing* results from interaction with reality itself (D'Ambrosio, 2011). This perspective also covers the libra-pound, since its use and origin predate the use of other units of measurement, such as the kilogram.

The libra-pound is considered an informal unit of measurement because, currently in Colombia, the government accepts only units of the International System of Units (SI). However, this fact does not prevent the libra-pound from being one of the most used units of measurement in Colombia. In this context, we can state that, in some cases, informality becomes more prevalent in everyday life than formality.

***Libras* and mathematics: polysemic words**

When we comment on the polysemy of a word, we refer to the plurality of its meanings or definitions. In polysemy, there are no true or false positions, nor absolute, but different and complementary meanings (Santos & Meneses, 2009; Zabala, 2015).

The word mathematics can have several meanings around the world, and this depends, in large part, on our specific culture. For example, Rosa (2010) notes the cultural dynamism in societies, stating that there are other realities, other societies, other cultures, and other mathematics.

Thus, it is possible to identify numerous existing mathematical practices that may be related to complementary local and global

mathematical ideas, techniques, procedures, and practices, since none predominates over the others.

By understanding the polysemy of the word mathematics, we acquire a more comprehensive and holistic stance that allows us to highlight mathematics as plural and not simply mathematics as singular, because, as Blanco (2008) states:

> From this perspective, we do not speak of mathematics, but rather of the various mathematical practices generated within Indigenous communities, Afro-descendant communities, professional groups, street children, among others. In this context, we can mention the mathematics of *palenqueros*[3], *guambianos*[4], *arhuacos*[5], carpenters, bricklayers, mathematicians, farmhand, and other cultural groups[6] (p. 3, our translation).

Thus, through ethnomathematics, the word mathematics can be conceived as "a culturally and socially contextualized construction, whose application and interpretation vary according to the different historical, social, and territorial environments" (Fernandes & Tamayo, 2024, p. 143). Thus, the generalization of mathematics can undermine a consensus that dialogue can mediate among the various existing positions.

The above, according to Paixão and Rosa (2024), suggests a more comprehensive and holistic view of mathematics, allowing the erasure of the Eurocentric understanding of a unique mathematics, in which the *knowings* and *doings* practiced and developed by members of different cultural groups are disregarded.

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[3]The *Palenquera* community is composed of descendants of enslaved people who, through acts of resistance and freedom, sought refuge in the territories of the northern coast of Colombia, since the 15th century, known as *palenques.* There are four recognized palenques: San Basilio de Palenque (Mahates, Bolívar), San José de Uré (Córdoba), Jacobo Pérez Escobar (Magdalena) and La Libertad (Sucre) (UARIV, 2023).

[4]The *Guambianos* are an Indigenous people who live above 2,500 meters above sea level, on the western slope of the central mountain range, in the central-western region of Cauca, Colombia (Vasco, 1992).

[5]The *Arhuacos* or *Ika* are a Colombian Indigenous people who live in the southeastern and southwestern paths of the Sierra Nevada de Santa Marta, at altitudes between 1000 and 4000 meters (Schlegelberger, 2016).

[6]"Desde este punto de vista, no se habla de la matemática, sino de las distintas y diversas prácticas matemáticas que se generan en el seno de las comunidades indígenas, comunidades afrodescendientes, grupos laborales, niños de la calle, entre otros. De acuerdo a esto, se puede hablar de las matemáticas de los palenqueros, los guambianos, los arhuacos, los carpinteros, los albañiles, los matemáticos, los campesinos u otros grupos culturales" (Blanco, 2008, p. 3).

Thus, mathematics "cannot be conceived as a universal language, because its principles, concepts, and foundations are not the same everywhere" (Rosa, 2024, p. 51). Therefore, in this research, we will not use the word mathematics in the singular (in Portuguese, "*a matemática*") because we understand that there are different forms of mathematics in our surroundings that, on many occasions, are ignored by the globalizing society.

The main objective of this research is to study the word libra, a polysemic and decolonial term that can adopt multiple conceptions or meanings, depending on the context or geographical location of the members of different cultural groups. Libra is polysemic both in definition and value, as seen in the plural form of the word (libras), because in countries such as Brazil, the United States, and the United Kingdom, the word differs from the meaning commonly attributed to it in Colombia.

For example, in Brazil, the term libra can be confused with the acronym of the Brazilian Sign Language (LIBRAS); in the United States and the United Kingdom, it is a unit of mass measurement (pound or lb) equivalent to 453.593 grams, and in the United Kingdom, the pound (pound sterling, whose symbol is £) is also the official currency of the region. Thus, for Rosa, Madruga, and Pinheiro (2024), polysemic dialogues enable a broader view of the world, in which knowing and respecting other positions allow us to contribute to the development of a world of peace, where dialogue overrides arms.

Methodological Procedures

The methodology used in this research is qualitative, with ethnographic characteristics, and is based on an adaptation of grounded theory (GT) proposed by Glaser and Strauss (1967). The use of these methodological components enabled a broad understanding of the

proposed problem, a detailed analysis of the information collected, and the problematization of these results through the implementation of a lesson plan in a state school in Ouro Preto, Minas Gerais.

Therefore, in this study, we analyze different notions that members of different cultures have about the libra in different contexts, in order to present them through a pedagogical action mediated by ethnomodelling. At first, this research was conducted in Colombia from September 2023 to August 2024, specifically in the city of Barranquilla, and then completed at the Federal University of Ouro Preto, from March to August 2025, in the city of Ouro Preto, Minas Gerais, Brazil, with the analysis and interpretation of the lesson plan applied in the school environment.

The data collection methods used in this study can be categorized into four main elements: a) field diary, b) semi-structured interviews, c) audiovisual recordings, and d) pedagogical action carried out at school. Guided by the principles of ethnography, information was collected from various sources and processed to establish a symbiosis between researchers and the researched (Bonilla, 2017).

This study was also conducted using data triangulation, in which the collection instruments were integrated in a complementary way for detailed, joint analyses and for the holistic interpretation of the results obtained in this research.

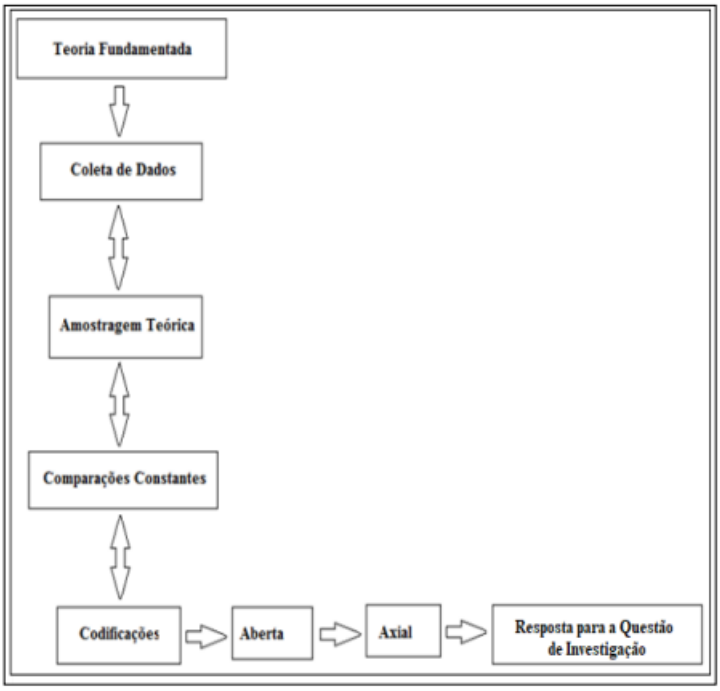
GT allows a detailed review of the information, providing legitimacy to the data collected, along with the coding and systematic analysis of the information obtained, to generate theoretical formulations of reality (Pirela Morillo, Blanco, & Nones, 2003).

GT has steps that, according to Gasque (2007), are: a) theoretical sampling, b) data coding, composed of open, axial, and selective coding, and c) writing an emerging theory. Given the interest in this research and the flexibility offered by GT, only the first two stages will be addressed:

theoretical sampling and data coding, with open and axial coding. Figure 1 shows the adaptation of the theory to the data used in this study.

Figure 1

Adaptation of the grounded theory (Andrade, 2020, p. 81)



It is important to note that we chose to adapt the GT because selective coding and the writing of an emerging theory were not used, as the researchers intended to seek possible answers to the research question. However, we must emphasize that this adaptation meets the objectives of this study, which are not related to the writing of a theory based on the data collected during the fieldwork of this research.

Thus, we used constant comparisons, with the conduct of data encodings, as a means to search for answers to the research question proposed for this study. The data were analyzed, and the results from two groups of participants from both countries, Colombia and Brazil, were interpreted and discussed in light of the theoretical and methodological foundations of this investigation.

It is important to emphasize that we used *cultural translation* in this research, which involves interpreting and explaining the internal meanings

of a practice, enabling members of different cultural groups to understand their own logic (Rosa, 2010). In ethnomodelling, translation enables us to understand emic (local) *knowing/doing* through pedagogical actions that connect it to the educational environment (Rosa & Orey, 2017a).

The research in Colombia began with semi-structured interviews with 20 participants from four contexts that were somehow connected to the libra as a unit of measurement. First, we conducted a review of the practice to identify possible locations and contexts directly or indirectly related to its use. Based on this literature review, we defined the locations and contexts in which semi-structured interviews were conducted for each participant during the fieldwork proposed for this study.

For developing the semi-structured interview script and choosing the place of study, we considered the ethnographic phase Aroca (2022) proposed, referent to the analysis of ethnomathematics present in a local practice or activity, enabling the collection, organization, and analysis of information through seven subphases: 1) prior knowledge, 2) place, 3) data collection strategies and methods, 4) immersion, 5) transcription, information analysis, and validation, 6) audiovisual promotions, and 7) contributions to the community or to the interviewees. Table 1 presents a brief profile of the participants in this study, based on fieldwork conducted in Colombia.

Table 1

General data of the interviewees (The authors)

Participant	Occupation	Gender[7]	Reference code	Context
1	Cook	F	CF	Kitchen
2	Shopkeeper	M	LM	Commerce
3	Fishmonger	M	FPM1	Commerce
4	Fishmonger	M	FPM2	Commerce
5	Fishmonger	M	FPM3	Commerce
6	Fishmonger	M	FPM4	Commerce
7	Greengrocer	M	VM1	Commerce
8	Former weight inspector	M	EIPM	Commerce
9	Greengrocer	M	VM2	Commerce
10	Avocado vendor	M	VAM	Commerce
11	Greengrocer	M	VM3	Commerce
12	Fruit and Vegetable vendor	M	VFLM	Commerce
13	Greengrocer	M	VM4	Commerce
14	Cassava and yam vendor	M	VMIM	Commerce
15	Personal trainer	M	TPM	Sport
16	Sportsman	M	EM	Sport
17	Chemistry student	M	EQM	Gym
18	Spice vendor	F	VTF	Commerce
19	Grain vendor	F	VGF	Commerce
20	Banana vendor	M	VBM	Commerce

Table 1 presents general participant data from the semi-structured interview conducted in Colombia. Regarding the interviewees and their request, this study was not conducted using their real names but rather with a unique identification acronym created by the researcher and his advisor.

To carry out the fieldwork in Colombia, we chose three specific locations in Barranquilla: the Barranquilla Market, the Universidad del

[7] F = Female; M = Male.

Atlántico, and the Las Flores neighborhood. These venues were selected for their commercial, social, and cultural dynamism, with an emphasis on commercial, sports, academic, and gastronomic activities.

The fieldwork conducted in Brazil involved 12 8th-graders from a state school in Ouro Preto, Minas Gerais. For these students, a contextualized lesson plan was implemented on July 16, 2025, from 10 am to 12 pm. Table 2 presents general information on the participants.

Table 2

General data of the students (The authors)

Participant	Gender	Reference code
1	F	*EF1*
2	F	*EF2*
3	F	*EF3*
4	F	*EF4*
5	F	*EF5*
6	F	*EF6*
7	F	*EF7*
8	F	*EF8*
9	F	*EF9*
10	M	*EM1*
11	M	*EM2*
12	M	*EM3*

Table 2 presents the general data of the students who participated in the application of the lesson plan prepared by the first author, showing the number of students, their gender, and their reference code, composed of the capitalized initials of the word student and their gender, and a number corresponding to their position in this table.

The lesson plan was prepared based on the information obtained in the semi-structured interview conducted in Colombia. According to this plan, the class lasted approximately two hours and was conducted through four moments: 1) Approaching, 2) Contextualizing, 3) Developing, and 4) Closing.

The data collected at these moments were critically compared based on the participants' responses to the questions asked at the first and last

moments. The purpose of this comparison was to identify the extent to which the scope of this lesson plan influenced the students' way of thinking, through the analysis of indicators of change or continuity, and also, by knowing, in an individualized way, their positions regarding the themes compatible with this lesson plan.

Data analysis and interpretation of the results

The information collected for this study in Brazil and Colombia, using various instruments, was analyzed through open and axial coding, respectively, stages of the GT that generated preliminary codes in open coding, which were later grouped by concept similarity into conceptual categories in axial coding.

Figure 2 shows the open coding performed with the participants in this study and presents some preliminary codes identified during the open coding process, based on codes identified with participants from Colombia and Brazil.

Table 3

Open coding process carried out with the participants of this study (Fieldwork)

Dados Coletados	*Codificação Aberta (Códigos Preliminares)*
1) Para você, o que é a Libra? *CF*: Pues la libra lo utilizamos obviamente para las recetas y para los pesos (1) sobre todo cuando son pedidos grandes pues se maneja la libra (3). *LM*: Son 500 gramas (2). *FPM1*: Bueno, una libra es son 500 gramos (2) y siempre lo mantenemos como para los clientes (3) no como que ellos sepan que es una libra de pescado (1) por decir son 500 gramas (2) o sea yo le dije 500 gramas eso es una libra (2). *FPM2*: Medio kilo (2). *VM1*: La libra es la medida (5) que utilizamos acá para despacho en el mercado (3). *VM2*: la libra es una medida de peso (5) que son 456 (2) pero aquí en Colombia se utiliza es 500 gr (6). *VAM*: La libra es una la libra porque ellos venden ahí es por kilo que trae 2 libras (7). *VM3*: La libra pues aquí usamos la libra (3) si es de pimentón verde ese se pesa por gramo o sea cada pimentón verde está pesando 5 gramos y ahí se saca una libra más o menos que son 7 pimentones, ya esto va pesando más (7) (Señala otro producto: cebolla) esto pesa una libra (8). *VFLM*: La libra es la mitad de un kilo (2). *VM4*: La libra es el peso (8) con el que trabajamos aquí en el mercado (3) lo que es medio kilo (2), la mitad de un kilo (2). *VMIM*: Una libra representa 16 onzas (4). *TPM*: Para mí la Libra es como una herramienta o un método para medir (5) o sea hacer una medida simplemente de masa (8). *EM*: La libra, una unidad de medida (8). *EQM*: La libra es una unidad de medida (8) que sirve más que todo para los alimentos (9) y su peso en gramos es 0,453 (2A). *VTF*: 500 gramas (2). *VGF*: Pesándolo ahí 500 gramos (2) que muestra el peso este porque este es digital no es de aguja (10). *VBM*: Lo que pasa es que aquí no trabajamos con esas medidas (11), aquí compramos por unidad vendemos por unidad (12). Aquí no se trabaja nada pesado (13). *EIPM*: La libra era 460 (2A) gramos ahora después la pasaron a 500 gramos (14). **2) ¿En qué momentos hace uso de la libra?** *CF*: Para nosotros, la libra normalmente no la usamos (11) porque son los gramajes sobre todo en receta son los gramos (11A) porque igual tú no vas a echar una libra (11B) de pronto si una libra de harina o algo así pero siempre todo lo demás son en los gramajes (11A). *LM*: Cuando la pidan suelta por ejemplo una libra de azúcar, una libra arroz, una libra de yuca (1). *FPM1*: Cuando vengan a comprar (3). *FPM2*: La libra pues algunas veces la he utilizado en mi labor diaria que es el entrenamiento o en clases de gimnasio también (1). *EM*:	(1) Relação da Libra com as práticas locais (2) Aproximação do valor da Libra 2A) Valor da Libra (3) Utilização da Libra (4) Relação entre Libras e Onças (5) A Libra como ferramenta ou método para medir (6) Valor da Libra na Colômbia (7) Evidências do processo de matematização (8) Libra como unidade de medida (9) Utilidade da Libra nos alimentos (10) Comparação entre instrumentos d medição (11) Não utilização da Libra

1a. Open coding of data from fieldwork carried out in Colombia.

Dados Coletados	Codificação Aberta (Códigos Preliminares)
Questões Iniciais ***a) O que vem na sua cabeça ao escutar a palavra Libra?*** *EF1*: Fazer movimentos com as mãos e com a boca (20). *EF2*: Uma forma de se comunicar (21) com pessoas que não escutam (22). *EF3*: É interessante para poder aprender e ensinar (23). *EF4*: Comunicar com pessoas (21) através de sinais (24). *EF5*: Se comunicar (21) com gestos (24) com pessoas surdas (21). *EF6*: Um signo (24) ou um modo diferente de se comunicar (21) através de gestos (24) com as mãos (22). *EF7*: Comunicar (21) com as pessoas que não escutam. (22). *EF8*: Uma forma de comunicação (21) que se usa com as mãos (20). *EF9*: Signo (24), linguagem de libras (surdos) (25). *EM1*: Não sei (26). *EM2*: Signo (24) ou equilíbrio (27). *EM3*: Não sei (26). ***b) Quais são as unidades de medida que você conhece?*** *EF1*: Trena, fita métrica, régua (28). *EF2*: Trena, fita métrica (28), medida de alimentos que no caso ml e kg (11C). *EF3*: Eu conheço porque já vi pessoas aprendendo e ensinando (29). *EF4*: Régua, balança, fita métrica (28). *EF5*: Balanças (9). *EF6*: Régua (28), centímetros, metros, milímetros (11C), fita métrica (28). *EF7*: Fita métrica (28). *EF8*: Trena, fita métrica (28). *EF9*: Milímetros, centímetros, metros, quilômetros, gramas, quilos, toneladas (11C). *EM1*: Metro (11C), peso, quilos, gramas (11C). *EM2*: Trena, balança, régua (28). *EM3*: Metro (11C), peso (11C), kilos, gramas (11C).	(2) Aproximação da Libra (7) Evidências do processo de matematização (8) Libra como unidade de medida (11) Não utilização da Libra (11A) Uso de gramas (11C) Utilização do sistema internacional de medidas (SI) (13) Não utilização de instrumentos de medição (14) Conhecimento local (émico) (20) A Libra como a ação de mover boca e mãos (21) Libra como forma de comunicação (22) Relação entre Libra e surdez (23) Libra como uma forma de educação (24) Relação entre Libra e sinais

1b. Open coding of data from fieldwork carried out in Brazil.

Table 3 presents the open codifications performed with the data collected from participants in Colombia (1a) and Brazil (1b). Figure 2a presents some preliminary codes identified during the open coding process, based on data emerging from semi-structured interviews with participants in Colombia. The structured interview conducted in Colombia consisted of seven questions addressed to a cook, some vendors, sportspeople, a coach, and some students.

Table 3 1b presents preliminary codes emerging from the open coding of data from participants in Brazil (8th-grade students from a state school in Ouro Preto, Minas Gerais). These participants were asked to

answer four initial questions and two final questions at the beginning and end of the lesson plan, respectively, for this pedagogical action.

Therefore, at the end of this process, all preliminary codes were classified into different conceptual categories through axial coding, with constant comparisons that considered the differences and similarities between the preliminary codes. The conceptual categories emerging from this process facilitated a better understanding of the data and enabled holistic interpretations of the study's results.

Table 4 shows the conceptual categories identified in the axial coding for the data collected from semi-structured interviews conducted in Colombia and from activities carried out through the application of the lesson plan in Brazil.

Table 4

Conceptual categories defined in the data coding process (Researchers' personal archive)

Open Coding (Preliminary Codes)	***Axial Coding (Conceptual Categories)***
(1) Relation of the *libra* to local practices. (A) (3) Use of *libra*. (A) (4) Relationship between *libra-pound* and ounces. (A) (5) The libra-pound as a tool or method for measuring. (A) (9) Usefulness of the *libra-pound* in food. (A) (11) Non-use of *libra*. (A and B) (12) Purchase and sale by unit. (A) (13) Non-use of measuring instruments. (A and B) (14) Local (emic) knowledge. (A and B) (15A) Relationship between *libras* and arrobas. (A) (15B) Origin of the *libra*. (A) (15c) knowledge transferred from generation to generation. (A) (16) Unconventional instruments for measuring the *libra*. (A) (20) *Libras* as the action of moving the mouth and the hands. (B) (21) *Libras* as a form of communication. (B) (22) Relationship between *Libras* and deafness. (B) (24) Relationship between *Libras* and signals. (B) (25) *Libras* as a language for deaf people. (B) (26) Ignorance of the term *libra*. (B) (27) Link between libra and balance. (B) (30) *Libras* and deaf-mute people. (B) (32) Non-use of *libra* in Brazil. (B) (33) Absence of measurement. (B) (42) Diversity of mathematics. (A and B)	Emic (Local) knowledge of libra (A) In Colombia (B) In Brazil
(2) Approximation of the value of the *libra-pound*. (6) Value of the *libra-pound* in Colombia. (11A) Use of grams. (11c) Use of SI. (15) Geographical influence on the use of *libra-pound*. (16A) Conventional instruments to measure the *libra-pound*. (17) Equal value of the *libra-pound* everywhere. (17A) Universalization of the value of the *libra-pound*. (18) Inadequate marketing of *libra-pound*. (28) Known measuring instruments. (38) Relationship between weight and units of measurement. (40) Misunderstanding of the question. (41) Uselessness of mathematics.	Etic (Global) knowledge of the *libra*
(2A) Value of the *libra*.	

(7) Evidence of the mathematization process. (8) *Libra* as a unit of measurement. (10) Comparison between measuring instruments. (11b) Disconnection between *libra-pound* and kilograms. (14A) Importance of the use of the *libra*. (16c) Daily experience with the *libra*. (19) Optimization and practicality. (23) *Libras* as a form of education. (29) Units of measurement as an educational element. (31) Interpretation of signals. (34) Polysemy of the *libra*. (35) Learning of units of mass. (36) New concept of the *libra*. (37) Operations with *libras*. (39) Use of school mathematics at home. (43) School mathematics in everyday life. (44) Mathematics outside of school.	Libra Dialogical (Glocal) Knowledge: Pedagogical Action

Table 4 presents the conceptual categories identified in fieldwork data from both Brazil and Colombia, along with the different ethnomodels based on the dialogical relationships among preliminary codes. These ethnomodels will be presented later through the interpretation of each conceptual category identified in this coding process.

Among the results from the researchers' field diary notes, the way students participating in the lesson plan in Brazil perceive the weight of different products and draw conclusions stands out. During the third part of the class, the students were divided into four groups of three each. Each group received a specific product (400 g of popcorn, 1 kg of beans, 2 lb of rice, and a 1 kg dumbbell) so that the students interacted with these products and asked different questions.

When asked the first question: a*: Which product is heavier?*, students from all groups agreed that it was the dumbbell, as it was the element that, at first glance, seemed more difficult to carry. This statement was reconfirmed by the students in the last question: c: *How is it possible to find the weight of the products?*, because, as they did not have any measuring instruments available, they decided to weigh the products with their hands, keeping the same idea about the dumbbell as being the heaviest product.

The students' doubts were addressed when performing the same exercise, but now using a kitchen scale as a measuring instrument, understanding that the measure of things will not always be determined by intuition. Figure 2 shows the different techniques students used to find the value of products, and their confirmation against the value entered on the scale.

Figure 2

Comparison techniques students used (Field diary)

2a) Técnica de medição utilizada por uma aluna | 2b) Medição do halter de 1kg | 2c) Medição de uma sacola de 2 lb de arroz

Figure 2 shows the different techniques students used to determine the weight of each product provided. Image 2a shows the technique a student used to find the values of the products (beans and a dumbbell) and determine which would be the heaviest. This student concluded that the beans weighed less because they were the product that gave the feeling of less weight. In turn, images 2b and 2c show the measurements of the dumbbell (1 kg) and rice (2 lb) taken with a scale, with values of 990 grams for the dumbbell and 1,017 grams for the rice.

According to this context, we infer that, although the values of 1 kg and 2 lb are equivalent in their standard value in Colombia (1 lb = 500 g), these values are approximations found in the real-world and, therefore, according to Orey (2025), it is necessary to establish a relationship of equivalence, approximation, or estimation between these values.

When performing this activity, the students could not understand why the dumbbell, with the exact value (measured on the scale), weighed less than rice and beans, which also weighed 1 kg, even though they

thought they should weigh exactly the same. This context shows that the mathematical practices used in daily life are related to rounding and approximations. According to Orey (2025), this example shows that culturally rooted mathematical practices exhibit inaccuracies specific to the dynamism of mathematics, as they approximate reality.

In this sense, the use of sociocultural practices fosters the cultural dynamism of mathematics, in which the rigor of the academy can acquire other investigative and pedagogical meanings, depending on the practice developed and the community in which it originated. For example, when studying the geometric thinking present in the making of Arhuaca backpacks, Aroca (2008), commenting on the *geometry of the approximations*, highlights that:

> All equivalent dimensions in a traditional figure are not equal; they are approximately equal. Indigenous cultures do not seek to be governed by accuracy, and the rigidity of school geometry does not exist here. Their interest does not consist in constructing congruent angles or sides; that is, the geometric transformations carried out in the Arhuaca backpacks do not maintain exact measurements but rather produce almost the same shape and size8 (Aroca, 2008, p. 81, our translation).

However, it is not our intention to delegitimize the rigor of academic mathematics or to erase it, as we know it is a fundamental characteristic of school mathematics; on the contrary, we only want to clarify that this school rigidity is not used in the same way by members of different cultural groups. In this context, D'Ambrosio (1990) argues that ethnomathematics do not aim to devalue school or academic mathematics, but rather to incorporate notions of respect, appreciation, collaboration, peace, and social justice into their educational practices.

As previously mentioned, the conceptual categories described in Table 5 were identified through the coding of data collected during

[8] Todos las magnitudes equivalentes en una figura tradicional no son iguales, son aproximadamente iguales. Las culturas indígenas no buscan regirse por la exactitud; la rigidez de la geometría escolar aquí no existe. Su interés no radica en construir ángulos o lado congruentes, es decir, que las transformaciones geométricas que se realizan en las mochilas arhuacas no mantienen exactly las medidas, pero sí casi la forma y el tamaño (Aroca, 2008, p. 81).

fieldwork in Colombia and Brazil, as well as through the researchers' field diaries in both countries.

It is also important to note that the identification of each of the codes shown in Table 5 resulted from a continuous analysis mediated by constant comparisons, in which the description of the conceptual categories allowed the information provided by the participants to be used in order to add a more holistic and faithful look at the research problem, thus contributing to the validity of this study with the aid of data triangulation (Moraes, 2003).

In this sense, for researchers to discover their own narrative, they must examine the ethnomodelling process through a detailed description of the fieldwork conducted. Thus, according to Rosa and Orey (2024), there are three approaches to ethnomodelling: local (emic), global (etic), and glocal (dialogical), which should be considered in research that employs the study of mathematical ideas, techniques, procedures, and practices developed by members of different cultural groups.

These approaches were used to describe the conceptual categories identified during the development of open and axial coding used in the development of the analytical and interpretative processes of this study. Below, we present the interpretations of each conceptual category identified.

a) Emic (local) knowledge of the libra in Colombia (A) and Brazil (B)

The preliminary codes that make up this category relate to the local (emic) approach to ethnomodelling, as each shows participants' views of their own customs, practices, beliefs, and/or traditions, as well as the mathematical *knowings/doings* of each culture.

Thus, the conceptions each participant has of the libra in this study varied according to each participant's culture, as they related the term libra mainly to their sociocultural environment and life experiences, which, as seen before, vary across countries. Thus, Rosa (2024) states that local

knowledge influences conceptions of the world, shaped by the practices developed by members of each cultural group, as the focus of local knowledge lies in the dynamic interaction among members of a given culture.

Thus, the local mathematical knowledge implied in the preliminary codes of this category can be represented and translated through emic ethnomodels, constructs from mathematical practices developed internally by a given culture and of local significance (Madruga, 2023).

An emic (local) ethnomodel can be found in the data from semi-structured interviews conducted in Barranquilla, Colombia. For example, when asking: *How do you measure or calculate the libra-pound?* The VFLM participant replied that: "The lulo, around five units of lulos is one libra-pound, six units of tamarillos are a libra-pound", evidencing the development of a mathematization process driven by his work experience.

We also infer that an emic representation of this practice is directed by a cultural artifact that seeks to relate the fruits (lulos and tamarillos) to the value of one libra-pound. Figure 3 shows the graphical representation of this emic ethnomodel.

Figure 3

Emic (local) ethnomodel emerging from the data (The authors)

A local (emic) explanation for the emic ethnomodel presented in Figure 3 can arise in relation to this context, commerce, as vendor VFLM directly related the libra-pound of the fruits to their units, facilitating counting by determining a sequence pattern and replacing conventional measuring instruments with a mental representation guided by experience through a process of mathematization of its own.

The interpretation of the results obtained in this category demonstrates that, for the participants of this study, the conception of the term libras is directly associated with their experiences with work practices, using daily activities as the first comparative resource. However, this comparison reveals several results in countries such as Colombia and Brazil, due to the polysemy of the word libras.

b) Etic (global) knowledge of the libra

The preliminary codes identified in this category are related to the ethnomodelling global (etic) approach, which considers the perspective of researchers or educators on the beliefs, customs, and mathematical or scientific knowledge developed by members of different cultural groups, through standards and metrics specific to academia (Rosa & Orey, 2017a).

Global mathematical knowledge, as implied in the preliminary codes for this category, can be represented and translated through etic ethnomodels, which capture school or academic relations and formal explanations in specific categories and metrics (Rosa & Orey, 2017a).

An example of an etic (global) ethnomodel in this study can be elaborated by analyzing and interpreting participants' answers to the semi-structured interview questions conducted in Colombia. For example, when asking: "*Is the value of the libra-pound the same everywhere?*" EIPM stated that: "(…) *You want to buy 3 lb of some good, and they don't sell you 3 lb, instead, they sell 2 and a half pounds, they still weigh 460 g*".

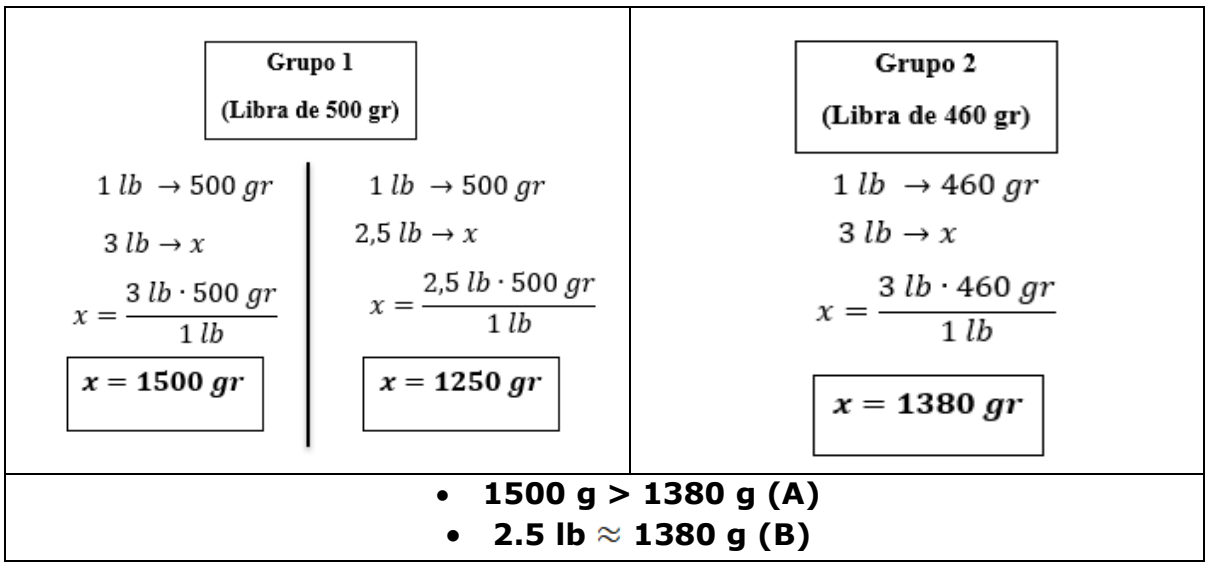
This answer evidences the development of a process of mathematization of its own, as well as a relationship between members of two cultural groups (vendors who use the libra-pound at 460 g and those who use it at 500 g). This fact reflects a sociocultural problem that often occurs in the Barranquilla trade, due to the lack of standardized measures in Colombian trade.

In the mathematization process carried out by this participant, the connections to school content are evidenced, as well as mental

calculations, approximations, estimations, and multiplications when relating three libra-pounds to 500 g and 460 g per pound. Figure 4 presents this etic ethnomodel.

Figure 4

Etic ethnomodel emerging from the data (The authors)



In the etic ethnomodel of Figure 4, an analytical representation of the mathematization performed by EIPM during the semi-structured interview with the participants from Colombia is presented. Thus, the researchers were able to synthesize, in a global sense, the local mathematical processes the participant used in their answer.

This ethnomodel shows that the vendors in group 2 sell less quantity of the product than the vendors in group 1 (A), as they use the 460 g libra-pound. In addition, when concluding that the three pounds sold by group 1 are equivalent to the two and a half pounds in group 2, they estimate close values (B). Thus, the etic ethnomodel presented in Figure 4 brings a representation created by the researchers, based on EIPM's local reality.

In this context, in agreement with Madruga (2024), an etic (global) ethnomodel corresponds to a globalizing view of an emic (local) ethnomodel, which relates to mathematical procedures not used by members of a given culture.

The interpretation of the results obtained through this conceptual category shows that, for the participants of this study, the (global) etic knowledge of the libra is rooted in the use of concepts and in the performance of procedures specific to school mathematics and the globalized-globalizing society, such as the use of approximations, the unification of measurement instruments, the universalization of values and the global geographic influence on local thinking.

In this sense, according to Rosa and Orey (2024), the global understanding of mathematics can be shaped by the persistence of colonial power structures to the present day, even centuries after the end of colonization.

c) Dialogical (glocal) knowledge of the libra: Pedagogical action

The preliminary codes identified in this conceptual category are related to the dialogical (glocal) approach to ethnomodelling, as it favors a more holistic view of mathematical knowledge through the connection between local mathematical *knowings* and *doings*, a product of a dialogical relationship that enables a symbiotic relationship between the researched culture and academia (Rosa & Orey, 2017a).

For D'Ambrosio (2001), the *programa etnomatemática* has as references categories specific to each culture by highlighting that mathematical knowledge has a symbiotic relationship with culture, as it refers to the interconnection and interdependence of members of different cultures, which influence each other, since it manifests itself in an exchange of values, ideas, procedures, techniques, and practices that can generate new ways of living and understanding the world, promoting respect and appreciation of cultural diversity.

Thus, to determine this category, the different answers given by the Colombian and Brazilian respondents were analyzed, allowing dialogues between participants' mathematical and non-mathematical *knowings* and *doings* and their sociocultural groups, thereby generating conclusions

grounded in consensus and developing intercultural representations of emic and etic mathematical knowledge (dialogical ethnomodels).

The glocal mathematical knowledge implied in the preliminary codes corresponding to this conceptual category can be represented and translated through dialogical ethnomodels. Cortes (2017) states that dialogical ethnomodels have as their main objective the translation of a local mathematical practice developed by members of different cultural groups, so that external observers can observe and explain it globally (global-holistic), according to locally developed *knowings* and *doings*.

A dialogical ethnomodel developed in this study was derived from the analysis and interpretation of the varied responses to the questions posed during the application of the lesson plan in a state school in Ouro Preto, Minas Gerais, Brazil. For the elaboration of this dialogical ethnomodel, we analyzed the answers four students gave to the same question. To gain a deeper understanding of this information, Table 5 presents the data for students who answered this question.

Table 5

Analysis of the answers given by the respondents (Fieldwork)

Question	***Participant***	***Answer***	***Implicit mathematical knowledge***
b) In your home, is mathematics used in a different way, that is, different from the way it is studied at school? Explain your answer. In what situations?	*EF1*	No. Because we don't calculate anything in libra-pounds, etc.	Global-etic
	EF8	No, because my mother doesn't use scales.	Global-etic
	EF9	It is used with a measuring cup per gram.	Local-emic
	EM1	Yes, phone, money, watch.	Local-emic

Table 5 presents the answers given by four students participating in fieldwork carried out in Brazil (Brazilian students) to a question proposed at the last moment of the class of this research. EF1's global mathematical knowledge stands out when she answers that the mathematics used at home is not used otherwise, since nothing is calculated using libra-pound, thus relating it to a school or academic term.

Likewise, participant EF8 stated that at home, mathematics is not used in the same way as in school, as her mother does not use the scale. This answer shows that mathematics is related to a single practice: the use of the scale.

In contrast, EF9 answers that in her home, mathematics appears in the use of a cup to measure by the gram, showing a local position in her mathematical knowledge when commenting on a mathematical practice performed at home rather than at school. Also, student EM1 stated that the mathematics used at home is different from that at school and named elements such as a telephone, money, and a clock, drawing a distinction between the mathematics in these elements and that used at school.

In this context, while students EF1 and EF8 present etic (global) mathematical knowledge through their responses when trying to universalize school mathematics, students EF9 and EM1 reflect otherwise on emic mathematical knowledge by implicitly stating that there are several forms of mathematics.

In this context, the development of the teaching method in the dialogical perspective, within the problem situation analyzed, emerges from the interaction between students' different perceptions of the use of mathematical knowledge in their daily lives. EF1's and EF8's answers show an etic (global) posture by associating home mathematics exclusively with school instruments, such as the scale, reiterating the notion of universalized mathematical knowledge.

In contrast, EF9's and EM1's answers revealed emic (local) knowledge by mentioning measuring cups, money, a telephone, and a clock, indicating culturally situated mathematical practices. According to Orey and Rosa (2021), the emic and etic approaches to mathematical knowledge stem from the fact that mathematics is often presented as a universal, acculturated discipline with its own unique language.

Thus, the dialogical approach of ethnomodelling enables the integration of different perspectives through cultural translations that articulate school knowledge and everyday *knowings* and *doings* in the

preparation of a dialogical ethnomodel. This model synthesizes global and local elements of the problem situation, enabling intercultural interpretations that value multiple ways of mathematizing (Rosa & Orey, 2017a). Thus, the pedagogical action proposed in this study becomes a space for the collective construction of knowledge, aligned with the ethics of respect for cultural diversity defended by D'Ambrosio (2001) and linked to Freire's dialogue as one of the foundations of meaningful, contextualized learning (Freire, 1996).

So, through ethnomodelling, the different postures presented above can be dialogically related to the elaboration of an ethnomodel that seeks the complementarity of the emic and etic approaches, which, initially, seem contradictory and disconnected. Figure 5 shows a graphical representation of the emerging ethnomodel from the previously analyzed and interpreted data.

Figure 5

Dialogical ethnomodel emerging from the data (The authors)

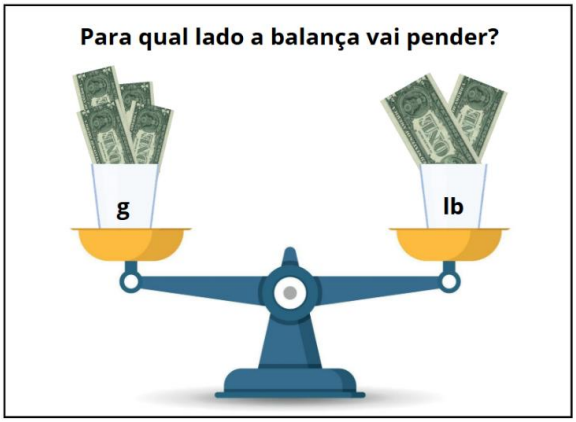


Figure 5 shows the graphical representation of a dialogical ethnomodel that connects the each participant's answers (see Table 4) when presenting a cultural artifact (scale) used globally, which was described by student EF8, which contains a beam composed of the instrument mentioned by student EF9 (cups meters per gram), which measure in grams and in *libra-pounds*, which are units of measurement students EF9 and EF1 mentioned.

Continuing with this explanation, there is paper money inside each cup to represent one of the elements used by EM1 to designate a mathematics that differs from the school mathematics (money).

It is important to highlight that the question at the top of Figure 5 was not designed to find right or wrong answers, but to highlight procedures that show the diversity of a specific mathematical *knowing/doing*, whether local, global, or glocal. However, we can agree on an answer as long as there is a dialogue between two different positions.

It is noteworthy that the conceptual categories described in this section are directed to the same objective, contributing to the development of pedagogical actions of ethnomodelling. According to Quesada (2023), this perspective can be considered a proposal for a renewed mathematics education that adds cultural aspects, significance, and technologies to the mathematics teaching and learning process developed in classrooms through problem situations contextualized in daily life.

Final Considerations

In this study, the researchers analyzed the polysemies of the term libra, which were examined through the development of ethnomodels (emic, etic, and dialogical) that summarize participants' conceptions of the term. Considering this research's results, we conclude that these participants hold numerous conceptions of the libra in both Brazil and Colombia, which are closely related to their *knowings* and *doings* across various contexts (school, work, experience, or sport). While in Colombia most conceptions of the libra are directed to a unit of measurement, in Brazil, this conception is directed to a specific language, the *Brazilian Sign Language* (*Libras*).

The elaboration and application of the lesson plan in Brazil, based on semi-structured interviews conducted in Colombia, constitute the educational phase of this study. They brought innovative results that

complemented the emerging results of fieldwork in Colombia, which aimed to develop ethnomodels that consider Brazilian and Colombian cultures.

In this context, we conclude that the term libra can be associated with different topics, depending on the geographical and cultural context of members of different cultures. Thus, the polysemic character of this term is evident once again. Based on the results of this study, we can also deduce the existence of other polysemic terms, such as *matemática*/mathematics, ounce, and ethnomathematic(s).

As for the term mathematics, it is important to note that during the development of the final questions at the last moment of the class, the answer given by the participant EF7 to the final question "b) In your home, is mathematics used in a different way, that is, different from the way it is studied at school? Explain your answer. In what situations?" was: "*No, because they are different ways*", showing an implicit and intuitive knowledge of the diversity of the existing mathematics, when stating that the mathematics used in his home is different from that developed at school.

Thus, the statement of the Brazilian participating student reflects the dynamism of mathematics, in which mathematical *knowing/doing* is not static, as it is constantly changing due to the complementarity of relationships among members of different cultures (Orey, 2024). The situation presented denies the supposed neutrality of mathematics, which has been used as a justification for imposing a unique, hegemonic model over the years that ignores cultural differences and various forms of knowledge production (Castro, 2025).

As for the equivalences between the units of measurement and the measuring instruments, through the results provided by Figure 2a and the emic ethnomodel of Figure 3, we conclude that the equivalences among units of measurement, in this case of mass, are not always compared with other units of measurement, but can also be carried out between the cultural artifacts originated in this context (Madruga, 2024).

Given the objective of adapting the GT used, we conclude that it is possible to establish a connection between the mathematical knowledge present in conceptions about libra (local-emic) and educational mathematics (global-etic), provided that the ethnomodels are elaborated and/or adapted correctly, considering the sociocultural context of members of different cultures.

In addition, this connection could exist only in one sense, culture-school, but also in its opposite sense, school-culture, when trying to model situations that occur in universal contexts (school) and consider them in specific contexts (determined cultures) with the purpose that different cultures know other ways of seeing and mathematizing the world, using ethnomodels proper to culture and school as a means to solve problem situations faced in daily life.

Finally, we conclude that the results of this research can help mathematics education by enabling the development and implementation of future, contextually and culturally grounded pedagogical actions. These activities can enable participating students to understand the relevance of cultural dynamism, as well as assist teachers in integrating practices mediated by ethnomathematics and cultural artifacts into the teaching and learning process in mathematics in schools, contributing to the development of mathematical thinking and the appreciation of sociocultural practices through ethnomodelling.

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